

EFFECTS OF CLICK + CONTINUOUS FOOD VS. CLICK + INTERMITTENT FOOD ON  
THE MAINTENANCE OF DOG BEHAVIOR

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There is disagreement among clicker trainers on whether or not food should be delivered every time the clicker (conditioned reinforcer) is used. However, presenting a conditioned reinforcer without food can weaken the strength of the conditioned reinforcer and also disrupt its discriminative stimulus function. A within subjects reversal design was used with 2 dogs to compare the behavioral effects of continuous pairings (C+F condition) vs. intermittent pairings (C+C+F condition) of the clicker with food. Results show that the C+C+F condition affects the frequency, accuracy, topography, and intensity of the behavior, and increases noncompliance and other unwanted behaviors. This study adds to the literature by evaluating the effects of conditioned reinforcement in an applied setting using discrete trials without undergoing extinction.

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## CHAPTER 1

### INTRODUCTION

Many people are now using clicker training as a quick and reliable method of training animals. In clicker training, a clicker is used to mark the exact occurrence of a desired behavior by pressing down on the clicker to make a “click” sound. The click is then immediately followed by a food reward (treat). The click sound is considered a conditioned reinforcer that increases the frequency of behavior that it follows. A conditioned reinforcer is defined as “a previously neutral stimulus that has acquired the capacity to strengthen responses because that stimulus has been repeatedly paired with food” (Mazur, 1998, p. 131). Some clicker trainers refer to the respondent procedure as *charging the clicker*, which refers to a rapid click-treat pairing session that builds the clicker as a conditioned reinforcer. However, Rescorla (1967) showed that the pairing (contiguity) of the conditioned stimulus (CS) and unconditioned stimulus (US) is not as important as the contingent relation between the CS and the US.

A little known fact in the clicker community is that the click sound also functions as a discriminative stimulus for approaching the feeder. An animal that is properly clicker trained will often orient or move toward the trainer at the sound of the clicker. The establishment of the sound as a conditioned reinforcer in operant conditioning is called magazine training. During this training in a Skinner box, food is delivered until the magazine sound reliably controls the behavior of approaching the feeder. From this point on, the sound of the magazine can be used to shape other behaviors.

Although most clicker trainers understand how to develop a conditioned reinforcer, there is much debate on how to maintain the conditioned reinforcer after it has already been established. Specifically, clicker trainers disagree on whether or not a treat must be delivered

after every click (Bailey & Bailey, 1997; Clayton, 2005; Fernandez, 2001). Proponents for always pairing every click with a treat believe that additional presentations of the conditioned reinforcer (clicker) without pairing it with a primary reinforcer (food) will weaken the strength and value of the conditioned reinforcer. Proponents for clicking always, but treating only occasionally, believe that occasional or unexpected treats will strengthen the behavior and increase resistance to extinction. In their view, the conditioned reinforcer is strong enough to be a reinforcer in its own right and does not need to be paired with food each time. In addition, they are concerned that the animal will receive too much food (Fernandez, 2001).

Many clicker trainers justify clicking for every correct behavior and treating only occasionally by appealing to the strengthening effects of intermittent schedules of reinforcement or partial reinforcement. However, these effects are not the same. Clicking after every correct response and treating only occasionally is not the same as intermittent reinforcement. In intermittent reinforcement,  $x$  number of responses are required before any reinforcer (primary or conditioned) is delivered. A conditioned reinforcer is never given without food also being delivered (except for chain schedules). In clicker training this would be accomplished by clicking after several correct responses and immediately following each click with food.

Clicking without delivering food resembles partial reinforcement in respondent conditioning when the CS is not followed every time by the US. Many earlier studies confirmed that the strength of a conditioned reinforcer lies in its ability to provide a reliable prediction of a primary reinforcer (de Lorge, 1967; Egger & Miller, 1962; Stubbs & Cohen, 1972; Zimmerman, 1957, 1969). If food no longer accompanies the conditioned reinforcer, the conditioned reinforcer begins to lose its effectiveness as a predictor of food. Rescorla and Wagner (1972) developed a model that graphically shows the weakening of a CS over time when it is no longer

paired with the US. Their model shows that when the CS is presented without food, the CS can acquire increasing amounts of inhibitory control and the response is increasingly suppressed.

Egger and Miller (1962) tested the strength of conditioned reinforcers by presenting two different overlapping stimuli to a group of rats. One of the stimuli (S2) always onset second and always preceded food delivery, while the other stimulus (S1) always onset first and was occasionally presented alone without food delivery. The stimulus that was always associated with food delivery (S2) initially maintained responding during extinction longer than the stimulus that was only sometimes paired with food (S1). The authors discuss that always having a reliable predictor of food during training might account for the differences in the results of previous studies which show that partial reinforcement is better at maintaining responding in extinction.

Lee and Gollub (1971) conducted an experiment with two pigeons using second-order schedules, where a stimulus (conditioned reinforcer) was presented both at the end of each response unit, and also right before food delivery after the entire set of response components was completed. The total number of responses was held constant at 256 for the entire component, but these responses were broken into varying fixed-ratio units of 128, 64, 32, 8, and 2. The conditioned reinforcer was a 0.5 second presentation of a green light at the end of each response unit and also after the final response component, which was followed by 5 seconds access to food (grain) (FR). Results showed that the highest response rates were during the FR 128 and FR 64 response components, and overall response rates decreased as the FR component got smaller. This shows that the conditioned reinforcer was weakened in the smaller FR component schedules where there were more conditioned reinforcer presentations without food. This means that continued presentations of the conditioned reinforcer, without the primary reinforcer (food),

reduced the effectiveness of the conditioned reinforcer, and so response rates decreased.

However, the patterns of responding within each component were similar to that of primary reinforcer schedules, so the conditioned reinforcer was still effective, just not as potent. The authors suggest that the overall decrease in response rate on schedules with smaller FR components could be from a breakdown of the discriminative function of the stimulus. When the conditioned reinforcer is not consistently associated with food probability, the pattern of response units is often not appropriate to the schedule.

Little research has tested the effects of presenting a conditioned reinforcer on every trial, yet only occasionally pairing the conditioned reinforcer with food, as many clicker trainers often do. There is only one study that has performed a similar type of test that used the magazine cycle as a conditioned reinforcer. Tombaugh (1970) used the magazine cycle to determine if conditioned reinforcer presentations on nonreinforced trials during acquisition made a difference using partial reinforcement. There were three groups of rats. Lever pressing of Group 100 was followed by sucrose on every trial, while the other two groups received partial reinforcement, where only 50% of the trials were reinforced with sucrose. Lever pressing of Group 50-100 received a conditioned reinforcer, the sound of the magazine, for every trial, whether sucrose followed or not. However, Group 50-50 received the conditioned reinforcer only on trials where sucrose was also delivered. Two experiments were run to determine if presenting the conditioned reinforcer during extinction had an effect. In the first experiment, the extinction trials had no conditioned reinforcer and no sucrose delivered. In the second experiment, the conditioned reinforcer was presented in the same manner during extinction as it was during acquisition, but no sucrose was delivered. The results of both experiments showed that the latency of Group 50-50 increased at the slowest rate during extinction. All three groups had



similar latencies during acquisition, but during extinction the latency of the two other groups were similar and higher than Group 50-50. This is in line with other research showing that with an increased number of conditioned reinforcer presentations without food, response rates will eventually decrease (de Lorge, 1967).

Typically, conditioned reinforcers have been studied in a free operant task and tested during extinction. The present study was conducted using discrete trials and to date there is no research using discrete trials and intermittent maintenance of the conditioned reinforcer. A within subjects reversal design is used to directly compare the behavioral effects of continuous versus intermittent pairings of the clicker with food during the maintenance of two dog behaviors. The purpose of this study is to compare the effects of continuously pairing a click with food delivery (C+F condition) vs. a click, click, food delivery schedule (C+C+F condition) where the click is always delivered for a correct behavior, but is paired with food for every other correct behavior.

## CHAPTER 2

### METHOD

#### Participants

Two dogs (*Canis familiaris*) were the participants: a 5-year old female Siberian Husky named Abby and a 4-year old male German Shepherd named Joe. Both dogs lived in the same household for approximately 4 years. The experimenter was introduced to the dogs on one occasion prior to the start of the experiment.

#### Setting

The experiment was conducted in the living room of the house where the dogs reside. The experimenter stood in front of a sofa chair with her right side touching the front of the chair. A large coffee table sat behind and to the left of the experimenter blocking most of the open space behind the experimenter, but there was enough room for the dog to walk by. The living room had two entryways and was an open area, so the dog could move freely around the room and into adjacent rooms. One of the dogs' two owners was always present and sat at a table in the adjacent connecting room. During sessions, the dog faced the experimenter and stood directly in front of the experimenter. There was a space approximately 0.914 m by 1.524 m to the right of the dog for it to perform the target behaviors. Between sessions the dogs were kept in a back room of the house either with the door to the room shut, or the door was left open and a gate was placed in the hallway to prevent the dog from leaving the area of the back bedrooms.

#### Materials

Materials used included a video camera and camera stand, DVC tapes, ink pens, data

sheets, a note sheet that listed the order of behaviors for each session, chairs and table, a clicker, four glass bowls to hold dog treats, and 10 dog treats for each session. There were four types of dog treats that were used as reinforcers: 1) Canine Carry Outs®- both beef flavor and beef and cheese flavor (Promark International, Inc., Boise, ID), 2) Purina® T Bonz®- sizzlin' steak flavor (Societe des Produits Nestle, S.A., Vevey, Switzerland), 3) Ol' Roy™ Pigz 'N Blankets (Wal-Mart Stores, Inc., Bentonville, AR), and 4) a generic brand of dog food. Each session contained a mixture of at least two of the four different types of dog treats. Some of the dog treats also came in several different flavors, so the dog had a variety of flavors throughout the session.

### Measurement

The dependent variables were the occurrence and nonoccurrence of cued spins and cued bows, opposite behavior, and cue repetition observed on each trial. Also recorded was the dog moving away from the training area during a session. A spin was recorded when the dog stood facing the experimenter and spun to the right in 360 degrees so that the dog was again facing the experimenter at the end of the spin and its front feet were in front of the experimenter. A bow was recorded when the dog put its front legs against the floor, but kept its back legs straight and standing up, and the head leaned down near the front legs but did not touch the legs. Observers were told to record every instance of spin or bow that occurred within the session. Spins and bows were recorded as correct when the dog performed the behavior that matched the cue the experimenter gave within 3 seconds of giving the cue. The behavior was recorded as opposite when the dog spun when the experimenter gave the cue to bow, or vice versa. The behavior was recorded as incorrect when the dog did not perform the behavior that matched the cue, the dog performed the spin or bow after 3 seconds of giving the cue, the dog performed the opposite

behavior, or when the dog moved away. If the behavior was incorrect, the trial was repeated and data was collected in the same way as in the original trial. Observers did not record any behaviors (except for moving away) performed by the dog from the 3 seconds after the cue was given until the trial was repeated. When the trial was repeated, observers numbered the behaviors in order of occurrence by writing a 1, 2, 3, 4, etc. next to each behavior. Cue repetition was recorded when the experimenter repeated the trial because the dog did not perform the behavior that matched the cue that the experimenter gave within 3 seconds of giving the cue. Observers wrote a number in the cue repetition column to indicate how many times the cue was repeated. Away was recorded whenever the dog left the 0.914 m by 1.524 m space in front of the experimenter during the session, except to perform a spin, or unless there was a reasonable distraction. Reasonable distractions included: the ringing of the doorbell, the garage door opening, or a nearby dog barking or walking by the front of the house. Any time there was a reasonable distraction, a “D” was recorded on the data sheet next to that trial.

Observers started the video camera at the beginning of each session and recorded data for all trials, and stopped the video camera at the end of the session. The duration of the session was recorded on the data sheets and was written as the time on the video camera when the session started and the time on the video camera when the session ended. The experimenter later recorded whenever the dog performed an opposite behavior by looking at the data sheets and determining if the behavior performed was opposite of the cue that was given.

## Procedure

### *General Procedures*

Before the sessions started for the day, the experimenter divided the dog treats into four

sets of 10 treats so that each set contained a variety of flavors. Each set of 10 treats was then placed into four glass bowls, which the experimenter used to hold the treats during the session. The experimenter also prepared a note sheet that showed which cue (spin or bow) was to be given for each trial for the first two sessions of that day. Once the first two sessions for each dog were finished, the note sheet sequence was repeated so that the order of spins and bows were the same for the first and third sessions and also the second and fourth sessions of the same day. The note sheet was placed on the sofa chair and was visible to the experimenter at all times during the session. Right before each session started, the experimenter picked up the clicker and glass treat bowl in her left hand, and walked over to the sofa chair and called the dog and/or motioned for the dog to come over with a pat on the leg. Most of the time the dog walked with the experimenter over to the sofa chair and looked at the experimenter's face. If the dog did not come to the location in front of the experimenter, the experimenter continued to call the dog, or in some cases pull the dog (only in click, click, food delivery (C+C+F) conditions), over to the desired location. Sessions began when both the experimenter and the dog were standing in front of the sofa chair and the dog was looking at the experimenter's face. To begin the session, the experimenter looked at the observer and nodded, which was a signal to start recording on the video camera and that the first trial was about to start.

The experimenter rotated which dog started first each day in such a way that the same dog started first on every other day that sessions were held in order to counterbalance order effects. After each dog's first session of the day there was a 1 to 3 minute break, depending on the dog's enthusiasm to start the next session. After the dog's second session of the day, the first dog was confined behind the gate in the back of the house and the second dog came out. Once the dogs switched locations for a second time, there was a midpoint break which lasted a little

longer (2 to 5 minutes) while the experimenter prepared more dog treats and put them into the four glass bowls. The last two sessions for each dog were then carried out in the same way as the first two sessions.

Sessions were held four times per day (on occasion there were only two or three sessions per day) for 3 to 6 days a week for approximately five months. The dogs were generally fed in the morning and sessions were held in the afternoon (between 3 and 6 p.m.). However, feeding times were not recorded and during the middle of the experiment it was noted that the owner started feeding the dogs in the early afternoon. The experimenter then required that at least 2 hours elapse between feeding and conducting the sessions.

### *Acquisition*

Luring (the use of food to prompt the behavior), fading, and successive approximations were used to train both dogs to spin and bow. Training consisted of three stages: 1) train the behavior (Step 1-5), 2) fade the lure (Step 6), and 3) perfect the hand signal and add the verbal cue (Step 7-8). During each trial the experimenter got the dog's attention, put her hand in place (with or without the lure), waited for the desired behavior or any approximation of it, and then clicked and treated. A step-by-step procedure was used where the dog had to complete each step for several trials before moving on to the next step. If the dog did not perform the target behavior right away, the experimenter continued to repeat the step or in some cases temporarily decreased the criterion (went back to the previous step) in order to get the dog back on track.

The final training for bow consisted of the experimenter moving her right hand to the middle of her body and then down approximately 12.7 cm to 15.24 cm towards the ground while saying "bow." The program for training bow consisted of eight steps. The goal of Step 1 was to

get the dog to put its head against the floor. The experimenter trained this by putting the lure between her fingers and placing her hand on the floor so that the dog had to put its head near the floor to get the treat. Once the dog's head was near the floor or any approximation of this, the experimenter clicked and set the lure on the ground for the dog to eat. The goal of Step 2 was to get the dog to put at least 1 of its front feet near its head when its head was against the floor. This was trained by waiting for the dog to place its head against the floor and then slowly dragging the lure on the floor away from the dog so that it had to move forward to get the lure. The goal of Step 3 was for the dog to put both of its front feet on the floor near its head when it placed its head against the floor. This was trained in the same way as Step 2, except occasionally the experimenter would have to move the treat towards the dog in order to get both feet in the correct position. The goal of Step 4 was to get the dog in the same position as Step 3 but leaning backwards on its front feet so that they were in front of the body. This was trained by waiting until the dog had its front legs together and its head down and then slowly guiding the treat towards the dog so that it shifted its weight backward. The goal of Step 5 was to have the dog perform a complete bow. This was trained by holding the lure on the floor and waiting until the dog bowed. In Step 6 the experimenter placed her open hand on the floor with no treat in it and waited for the dog to bow. In Step 7 the experimenter slowly faded her hand from the ground up higher and higher until her hand was in the same position as the hand signal which was then used to cue the behavior. Once the dog was able to bow when the hand signal was given, in Step 8 the experimenter said "bow" at the same time that the hand signal was given.

The final training for spin consisted of the experimenter moving her right hand in a fist from her right side across her waist to the left side of her body. The program for training spin consisted of eight steps. The goal of Step 1 was to get the dog to turn its head to the right. The

experimenter trained this by putting the lure between her fingers and moving her hand to the right of the dog's head. The goal of Step 2 was to get the dog to move its front feet to the right side. This was trained by slowly moving the lure along the dog's right side until it moved its front feet to the right. The goal of Step 3 was for the dog to do a half spin where the dog turned 180 degrees to the right. This was trained by moving the lure along the dog's right side towards its tail. The goal of Step 4 was to get the dog to perform a three fourths spin to the right. This was trained by moving the lure along the right of the dog's body and slowly around to the other side of the dog's body so the dog had to turn around to get the treat. The goal of Step 5 was to get the dog to spin a full 360 degrees to the right so the dog was facing the experimenter at the end of the spin. This was trained by moving the lure around the dog's entire body from the right. In Step 6 the experimenter moved her empty hand in a circle from the right of the dog around the dog's body until the dog started to spin. In Step 7 the experimenter moved her hand forward towards the back of the dog's body, but in decreasing increments so that the dog would start to spin with less and less of the hand guide, and then the experimenter would quickly move her hand back to her side. Once the dog was able to spin by using the final hand signal, in Step 8 the experimenter began to say "spin" at the same time as the hand signal was given.

#### *Click with Food Delivery (C+F) Schedule*

Sessions consisted of 10 trials, five spin and five bow, which were randomly interspersed throughout the session. Each trial began when both the experimenter and dog were in location standing in front of the sofa chair and the dog was looking at the experimenter's face. The trial started when the experimenter simultaneously gave the verbal cue and hand signal and ended either when the dog ate the treat or when 3 seconds had elapsed and the desired behavior did not



occur. If the dog performed the behavior that matched the cue the experimenter gave within 3 seconds, the experimenter clicked by pressing the metal portion of the clicker down, and then immediately gave the dog a treat (reinforcer) from the glass bowl. In order to make the trials consistent, the experimenter waited 3 seconds after the dog was given the treat before starting the next trial.

In this condition, every time there was a click the dog also received a treat. The experimenter delivered praise immediately after the click by saying “good job” for every correct trial. If the dog did not perform the desired behavior within 3 seconds or the dog performed the opposite behavior, then the experimenter turned away from the dog and faced the sofa chair for 2 to 3 seconds. If the dog stood still for the 3 seconds after the cue was given, then the experimenter waited until the 3 seconds was up before turning to face the chair. However, if the dog performed the opposite behavior or did any other behavior, then the experimenter turned to face the sofa chair immediately after the incorrect behavior. After the 2 to 3 second time-out, the experimenter then turned back towards the dog and repeated the trial once the dog was looking at the experimenter. If there were any distractions that disrupted the dog from finishing a session, the experimenter quickly tried to get the dog back to the desired location, settled down (standing still and quiet), and ready to continue the session. If the dog did not come to the desired location, then the video camera was stopped and the session was put on hold until the dog settled down. Once the dog settled down, the experimenter called the dog over to the desired location in front of the sofa chair, the video camera was restarted, and the session continued.

In the final C+F and C+C+F conditions the experimenter no longer delivered praise by saying “good job.” When the dog performed the correct behavior, the experimenter only clicked

and immediately gave the dog a treat. Praise was no longer given to determine if the praise had any influence on the behaviors for trials when a treat was not delivered.

*Click, Click, Food Delivery (C+C+F) Schedule*

This condition was the same as the C+F condition, with the exception that the experimenter delivered the dog treat for every other trial of the same behavior. On this schedule, the dog had to perform the correct behavior for two trials in a row of that same behavior before a treat was given. On trials when the correct behavior was performed, but a treat was not given, the experimenter clicked and then waited 3 seconds for the next trial to begin.

In this condition, the experimenter highlighted every other spin trial on the note sheet, where in highlighted trials the dog did not receive a treat. Since the dog had to repeat the trial until it was performed correctly, the experimenter gave out a treat on every other trial of the same behavior. The experimenter then did the same for the bow trials. Since there was an odd number of both spins and bows in each session (five spins and five bows), the experimenter rotated highlighting the first trial and every other trial of the same behavior, with highlighting the second trial and every other trial of the same behavior, in order to keep the schedule varied. Whenever the dog performed a correct behavior on a highlighted trial, the experimenter only clicked and did not deliver a treat. Praise was not given on highlighted trials to see if the praise had any influence on the behaviors for trials when a treat was not given.

The first C+C+F condition of the experiment was conducted on both a C+F and C+C+F schedule. In this condition, Abby's spins were on a C+F schedule, while bows were on a C+C+F schedule. For every correct spin Abby performed, she received a click and treat and the experimenter said "good job." For every correct bow Abby performed, she received a click and

“good job,” and only received a treat for every other correct bow. Joe had the opposite schedule- bows were on a C+F schedule and spins were on a C+C+F schedule. This condition was originally used to see if the behavior that was on a C+C+F schedule would show a marked decrease in performance compared with the behavior that was on a C+F schedule. However, it was determined that the two behaviors, spin and bow, could not be equated and so a comparison of the two behaviors was not valid. Therefore, this condition was switched to the C+C+F schedule for both behaviors so that each behavior could only be compared to itself in the C+F and C+C+F conditions.

### Design

A single-subject reversal design was used with both dogs. It was an ABABAB design. The dogs were trained to spin and bow to both the visual and hand cues given by the experimenter. Once both dogs were able to spin and bow at a rate of 90% correct or better, then the first C+F condition began. The first C+F condition lasted about 40 sessions and stopped once there were seven consecutive sessions in a row where no trials were repeated. The remaining C+F conditions and all of the C+C+F conditions were run until a visual examination of the graphs showed stability.

### Reliability

There were 2 observers, both of whom were the dogs’ owners, who collected data and operated the video camera. One owner was the primary observer, while the other owner was mainly used for interobserver agreement and on occasions when the primary observer was not available. The experimenter also reviewed the camcorder tapes on occasion and established

interobserver agreement by taking data from the tapes. Interobserver agreement was calculated by taking agreements / (agreements + disagreements) x 100 to get the percent agreement. Interobserver agreement was 100% for both the experimenter and the second observer for all sessions.

## CHAPTER 3

### RESULTS

Figure 1 (top) shows the daily sum of spins, bows, and opposite behavior for Abby and the bottom graph shows the daily sum of cue repetitions for Abby. There were no occurrences of away for Abby during any of the conditions. During the first click with food delivery schedule (C+F) condition (top graph), spins started and ended at 20 correct and bounced between 17 and 20 correct in the middle (average of 19.2). Bows started at 17 correct, bounced between 17 and 20, and ended at 20 correct (average of 19.1). Only one incidence of opposite behavior occurred near the beginning of the condition (average of 0.1). Cue repetitions (bottom graph) started at three repetitions, bounced between one and five, and ended at zero repetitions (average of 1.8).

When bows were switched to the click, click, food delivery schedule (C+C+F) condition (top graph), spins started at 18 correct, bounced between 18 and 19, and ended at 20 correct (average of 18.83). Bows remained at 20 correct, except for one drop to 17, before ending at 19 correct (average of 19.33). There was one opposite behavior at the end of the condition (average 0.16). Once both behaviors were switched to C+C+F, spins started at 20 correct, bounced between 15 and 20, and ended at 15 correct (average of 17.14). Bows remained at 20 correct, except for one drop to 19 correct in the middle of the condition (average of 19.86). Opposite behavior started and ended at zero, with two opposite behaviors occurring near the end of the condition (average of 0.29). When bows were switched to the C+C+F condition (bottom graph), cue repetitions started at two repetitions, bounced between zero and five, then ended at one repetition (average of 1.83). When both behaviors were switched to C+C+F, cue repetitions started at zero, bounced between zero and ten, and ended the condition with six repetitions (average of 4.43).

Reversal back to C+F showed that spins started at 18 correct, bounced between 14 and 20, and then ended at 20 correct (average of 18.58). Bows remained at 20 correct, except for a decrease to 19 correct in the middle of the condition (average of 19.92). Opposite behavior started at one, bounced between zero and two, and then ended at zero opposite behaviors (average of 0.58). Cue repetitions (bottom graph) started at five repetitions, bounced between zero and six, and ended at zero repetitions (average of 1.83).

When switched to C+C+F (top graph), spins started at 17 correct, bounced between 15 and 20, and ended at 19 correct (average of 18.09). Bows started at 20 correct, bounced between 16 and 19, and ended at 17 correct (average of 18.36). Opposite behavior started at zero, bounced between zero and two, and ended at two opposite behaviors (average of 0.56). Cue repetitions (bottom graph) started at three repetitions, bounced between two and six, and ended at six repetitions (average of 4.27).

Reversal back to C+F showed that spins started and ended at 20 correct and bounced between 18 and 20 correct in the middle (average of 19.5). Bows started and ended at 20 correct with only one drop to 18 and one drop to 19 correct (average of 19.79). Cue repetitions (bottom graph) started and ended at zero and bounced between zero and two in the middle (average of 0.71).

In the final C+C+F condition, spins started at 16 correct, bounced between 15 and 20, and ended at 20 correct (average of 18.5). Bows started at 20 correct and then steadily decreased down to 12 correct (average of 17.67). Opposite behavior started at zero and then steadily increased to up to four opposite behaviors (average of 1.17). Cue repetitions (bottom graph) started at three, bounced between two and four, and ended at eight repetitions (average of 3.83).

Figure 2 (top graph) shows the daily sum of spins, bows, and opposite behavior for Joe. The bottom graph shows the daily sum of cue repetitions and aways for Joe. During the first C+F condition (top graph), spins started at 18 correct, bounced between 17 and 20, and ended at 20 correct (average of 19.0). Bows remained at 20 correct with two drops to 19 correct in the middle of the condition (average of 19.75). Opposite behavior started and ended at zero and bounced between zero and one in the middle (average of 0.38). Cue repetitions (bottom graph) started at two repetitions, bounced between one and three, and ended at zero (average of 1.5). There were no aways during this condition.

When spins were switched to the C+C+F condition (top graph), spins started at 18 correct, bounced between 13 and 17, and ended at 17 correct (average of 15.73). Bows, which remained on the C+F schedule, started at 19 correct, bounced between 19 and 20, and ended at 20 correct (average of 19.45). Opposite behavior started at two, bounced between zero and two, and ended at one opposite behavior (average of 0.73). Once both spin and bow were switched to the C+C+F condition, spins started at 13 correct, bounced between 16 and 19, and ended at 18 correct (average of 16.5). Bows started at 18 correct, bounced between 16 and 18, and ended at 17 correct (average of 17.25). Opposite behavior started at zero and then remained at two for the rest of the condition (average of 1.5). When spins were switched to the C+C+F condition (bottom graph), cue repetitions started and ended at three repetitions and bounced between 3 and 10 in the middle (average of 5.0). Aways started at zero, bounced between zero and nine, and ended at six aways (average of 2.45). Once both spins and bows were switched to the C+C+F condition, cue repetitions started at 13 repetitions, decreased to six and then three, and ended at five repetitions (average of 6.75). Aways started at five, increased to 10 and then dropped to one, and ended at three aways (average of 4.75).

Reversal back to C+F (top graph) showed that spins started and ended at 20 correct and bounced between 17 and 20 in the middle (average of 19.0). Bows started at 19 correct, bounced between 18 and 20 correct, and ended at 20 correct (average of 19.08). Opposite behavior started at one, bounced evenly between zero and one, and ended at zero (average of 0.5). Cue repetitions (bottom graph) started at one repetition, bounced between zero and six, and ended at zero (average of 2.0). Aways started and ended at zero and bounced between zero and four in the middle (average of 0.75).

When switched to the C+C+F condition (top graph), spins started at 20 correct, bounced between 13 and 20, and ended at 16 correct (average of 17.2). Bows started at 19 correct, bounced between 16 and 19, and ended at 14 correct (average of 17.7). Opposite behavior started at one, bounced between zero and three, and ended at zero (average of 0.6). Cue repetitions (bottom graph) started at one, bounced between 2 and 12, and ended at 15 repetitions (average of 5.9). Aways started at zero, bounced between zero and two, and ended at four aways (average of 1.0).

Reversal back to C+F (top graph) showed that spins started and ended at 20 correct and bounced between 18 and 20 in the middle (average of 19.67). Bows remained at 20 correct, except for two drops to 19 correct near the end of the condition (average of 19.87). Opposite behavior remained at zero, except for an increase to one opposite behavior in the middle (average of 0.07). Cue repetitions (bottom graph) started and ended at zero and bounced between zero and two in the middle (average of 0.47). There were no aways during this condition.

In the final C+C+F condition (top graph), spins started at 17 correct, bounced between 12 and 18, and ended at 15 correct (average of 15.83). Bows remained at 19 correct, except for a decrease to 18, before ending the condition at 20 correct (average of 19.0). Opposite behavior



remained at zero, except for an increase to one on the last day (average of 0.17). Cue repetitions (bottom graph) started at four repetitions, bounced between 3 and 10, and ended at five repetitions (average of 5.67). Always remained at zero, except for an increase to one near the end of the condition (average of 0.17).

## CHAPTER 4

### DISCUSSION

The results show that delivering a treat after every other correct behavior, rather than after every correct behavior, affects the frequency, accuracy, and topography of the behavior. In the click, click, food delivery schedule (C+C+F) condition there was also increased noncompliance and other unwanted behaviors. Therefore, the C+C+F condition is not an adequate modification of clicker training. This supports previous research (de Lorge, 1967; Egger & Miller, 1962, Tombaugh, 1970), which has shown the importance of continuously pairing the conditioned reinforcer with food.

When the experiment first started, it was intended to have spins and bows on an alternating treatments design, where one behavior would remain on the click with food delivery (C+F) schedule and the other behavior would be on the C+C+F schedule, then each behavior would be switched to the opposite schedule when the condition changed. However, in this condition Abby's bows were on the C+C+F schedule, yet spins were more affected than bows. Therefore, both behaviors were switched to the C+C+F schedule. Overall, bows were stronger than spins for both dogs, which suggests that bows are less effortful than spins. Abby also seemed less affected by the C+C+F condition than Joe. Perhaps this was due to Abby's history with verbal praise, and that is why the removal of verbal praise in the last condition showed more of an effect with Abby.

During the C+C+F conditions, the frequency and accuracy of the target behaviors were less for both dogs. Overall, there were more cue repetitions on the C+C+F condition than on the C+F condition. Some trials during the C+C+F condition even required as many as four cue repetitions in order to get the correct behavior. Trials were repeated until the correct response

occurred in order to ensure that the dogs emitted the target behavior before proceeding and to keep the amount of treats delivered constant per session. However, if the trials were not forced, the dogs might perform only the behaviors that are followed by a treat and would avoid trials where the conditioned reinforcer is presented without a treat. Future research should determine if the results would be similar if the trials were not forced.

Anecdotally, an additional effect of the C+C+F condition was that the willingness of the dogs to come to the sessions changed. When the experiment first started, both of the dogs either followed the experimenter around until the session was ready to start, or they sat in the location where sessions were held and waited for the experimenter to come over. In either circumstance, the dogs would often be in standing position with tails wagging once the experimenter was ready to start the session. However, when the C+C+F condition was implemented, the dogs did not go to the location where sessions were held as quickly and there was less tail wagging in general, both before and during the sessions. Also during this condition, the dogs did not as often wait in standing position between trials and so the experimenter had to take time to get them in a standing position.

The topography of the behavior also changed during the C+C+F condition, especially for Joe. Once switched to the C+C+F condition, Joe began to walk further around the room and in a larger circle to complete his spins. Also in this condition, both dogs performed some of their bows by moving their front legs only part of the way down to the floor. The speed of the behavior was also affected. In the first C+F condition, both dogs galloped into the spins and spun and bowed quickly. However, after switched to the C+C+F condition, both dogs took more and slower steps to complete their spins, and both spins and bows were not performed as quickly.

One thing that is novel to this study is revealing the effects of conditioned reinforcement on other behaviors in addition to the target behaviors. These other behaviors emerged during the C+C+F condition and were unwanted behaviors. Both dogs, especially Abby, started to lie down after bows and would occasionally sit between trials when a treat was not delivered. This caused a delay because the experimenter had to get the dog in a standing position before the next cue could be presented. The biggest problem with other unwanted behaviors, however, began to emerge for Joe. Joe started to leave the sessions and walk away from the experimenter into the other room. There were even a few occasions, once Joe was switched to the C+C+F condition, where Joe would not come into the room where sessions were held, even after lots of coaxing from the experimenter, and so the experimenter had to drag him in. Both dogs also began licking and sniffing the experimenter's hand on trials where a treat was not delivered. This shows that the C+C+F condition interfered with the discriminative stimulus association since it no longer signaled that food is coming.

Interestingly, these results suggest a carryover effect into the C+F condition. Both Abby and Joe had more cue repetitions, and Joe had more aways, in the second C+F condition than in any of the other C+F conditions. It might be possible that by the later conditions the dogs began to discriminate between conditions and recover faster through repeated reversals. By the final C+F condition, there were even fewer cue repetitions and behavioral variance than the very first C+F condition.

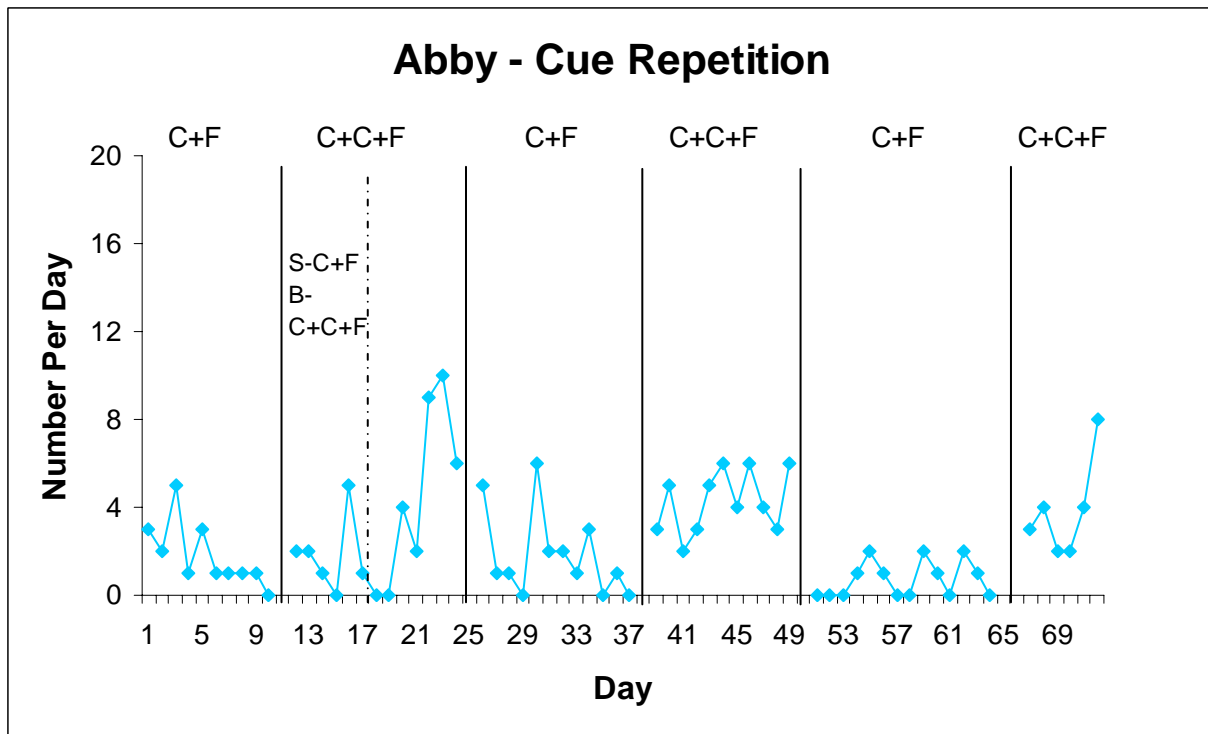
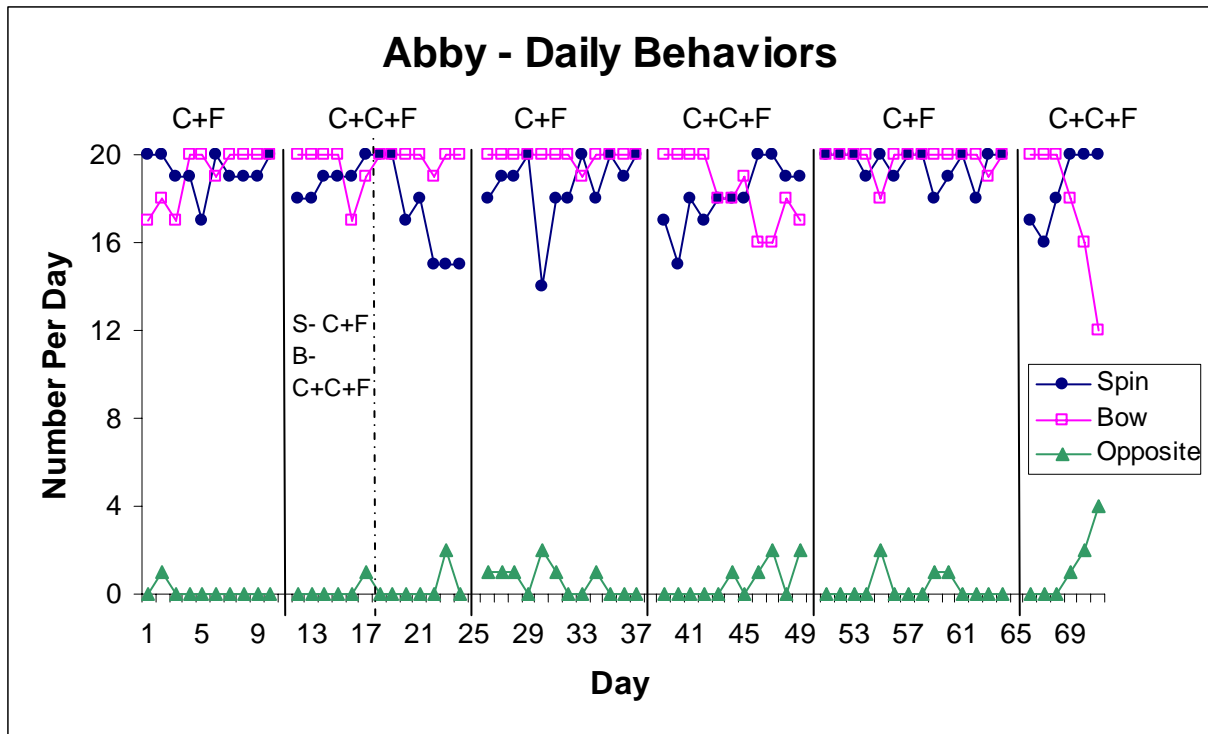
Many animal trainers feel that they will be reinforcing too many behaviors in a day to give out treats for every click. There are several solutions to this problem. First, a reinforcer does not always have to be food. A reinforcer can be things such as petting, play time, access to a favorite toy, playing fetch, etc. Second, the food reinforcers do not have to be "treats." A

portion of the animal's regular meal can be given out as a reinforcer, and can also be mixed in with treats (food not necessary in the animal's diet, but that the animal enjoys) to ensure that the animal is not receiving too many calories each day.

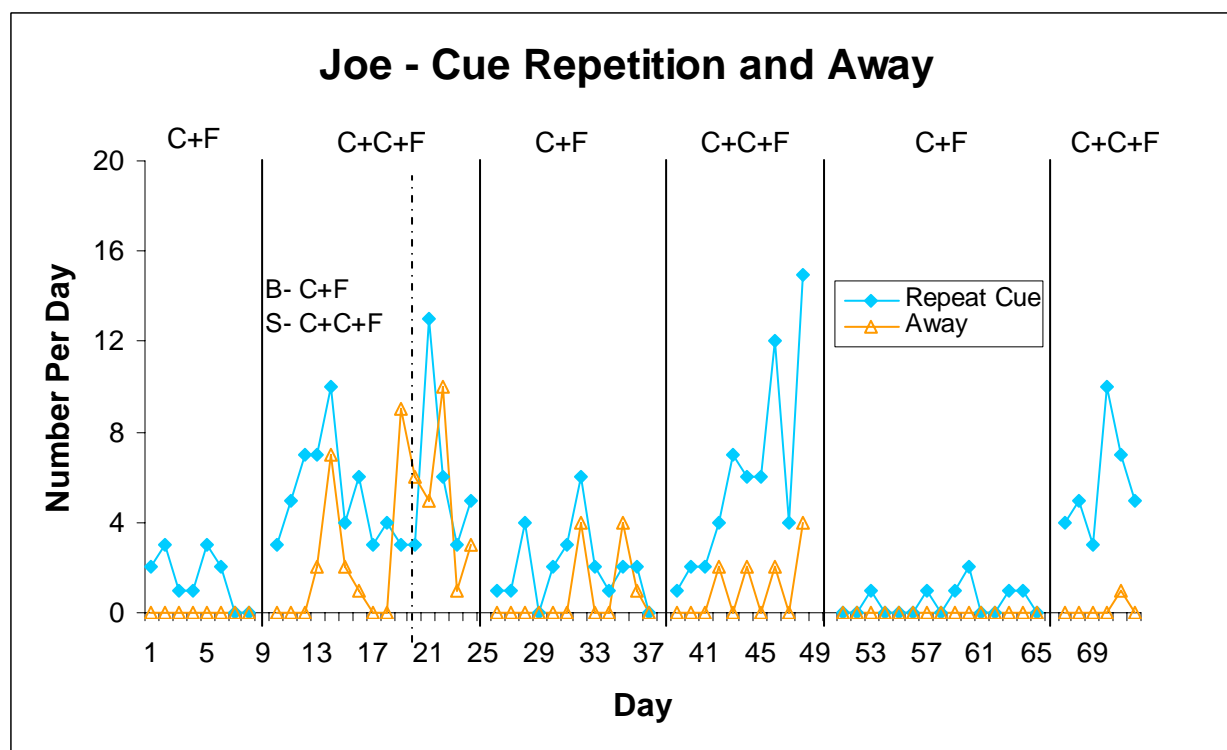
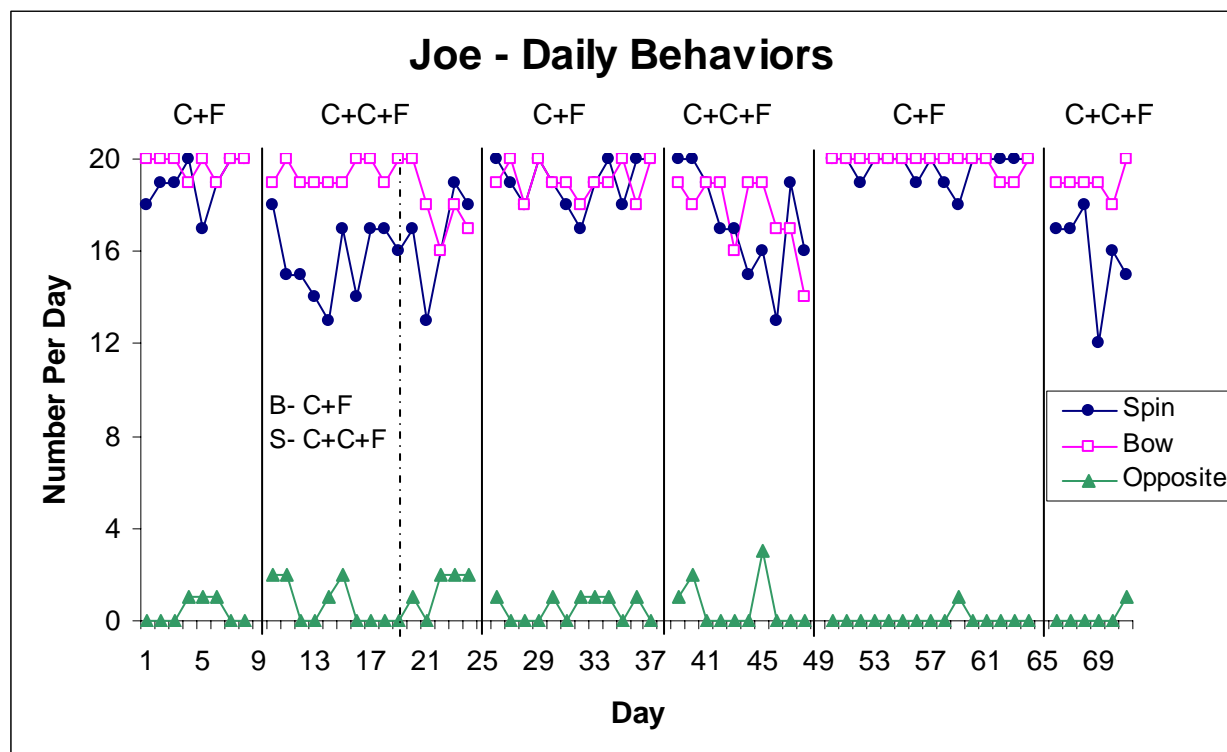
A third way to reduce the amount of food delivered is to vary the size of the food reinforcers so that some are smaller than others. Lehr (1970) found that a variable magnitude of reward resulted in increased resistance to extinction as compared to consistent presentations of either an average amount of food or a larger amount of food. A fourth way to avoid distributing too many treats is to properly use a ratio schedule of reinforcement. A variable magnitude of response (VR) or food response (FR) schedule can be used so that the behavior has to occur more than once before a click and treat is given. For example, on a FR 2 schedule, the correct behavior has to occur two times before any clicks or treats are given. An important note when using this schedule is that all clicks must be followed by a reinforcer and a click should never occur without a reinforcer being delivered. A final solution to giving out too many treats would be to reinforce longer durations of the behavior or longer behavior chains.

This study contributes to the literature in several ways. First, this study directly compares the behavioral effects of continuous versus intermittent pairings of the clicker with food. Second, this study is unique in that it shows the direct effects of manipulating conditioned reinforcer presentations without extended extinction conditions. Third, this study uses discrete trials and intermittent maintenance of the conditioned reinforcer. Another feature of this study is that it was conducted using a within subjects reversal. This gives the advantage of comparing the behavior in each of the two conditions to itself over time so an overall effect can be seen for both dogs.

Many people who do not use clicker training properly (i.e. following every click with a treat) might disregard clicker training as flawed because they see extra unwanted behaviors emerge and the frequency and intensity of the cued behavior is not very desirable. However, this might be due to the overall reduction of reinforcement and to the alteration of the discriminative stimulus function of the click when it is presented without food, rather than from respondent extinction. If food is delivered on an intermittent schedule, then the conditioned reinforcer should always be followed by food in order to maximize performance. An occasional accidental click without a corresponding treat should not have much of an effect, but in general every click should be followed by a reinforcer.



*Figure 1.* The top graph shows the daily sum of spins, bows, and opposite behaviors for Abby. The bottom graph shows the daily sum of cue repetitions for Abby.



*Figure 2.* The top graph shows the daily sum of spins, bows, and opposite behaviors for Joe. The bottom graph shows the daily sum of cue repetitions and aways for Joe.



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